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Effect of high-temperature treatment on the properties of an alumina-chromium catalyst for the dehydrogenation of lower paraffins

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Abstract

The crystal and pore structures of a microspherical alumina-chromium catalyst calcined at 800-1100 C were studied using a set of currently available physicochemical techniques (X-ray diffraction, lowtemperature nitrogen adsorption, diffuse reflectance UV-vis spectroscopy, Raman spectroscopy, and EPR spectroscopy); the state of its active component and the catalytic properties in isobutane dehydrogenation were examined. As the calcination temperature was increased from 800 to 900-1000 C, the properties of the catalyst were improved as a result of the formation of Cr2O3 clusters in an optimum amount and a decrease in the surface acidity of the catalyst due to the dehydroxylation and phase transformations of the aluminum oxide support. Calcination at 1100 C was accompanied by a decrease in the yield of isobutylene as a result of the formation of inactive macrocrystalline chromium (III) oxide and a chromium species inaccessible to reacting molecules; this chromium species was encapsulated in closed pores as the constituent of a solid solution of α-Al2O3-Cr2O3.

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